

A Web-based 3D Glossary for Anthropometric Landmarks

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ABSTRACT

We have created a visual 3D anthropometric landmark glossary usable over the Web. Implemented using VRML, the Virtual Reality Modeling Language, users may easily locate and determine the names of these landmarks. Landmarks are visualized as small spheres located over the body. Users can select the landmark name and the display is adjusted to place the viewer in front of that location. In addition users can select from among different landmark nomenclatures. The landmarks also highlight when selected, giving visual feedback. In addition a number of reference planes, such as the Frankfort plane and the coronal, sagittal and transverse planes can be turned on or off. Additional display controls are available via a movable control panel. The initial set of landmark names comes from the CAESAR (Civilian American and European Surface Anthropometry Resource) project. Three versions of the system have been implemented. The first is a head only model. Names for the head model are displayed simply by moving the cursor over the spheres and no selection is needed. The other two versions, requiring the user to click a selection, function identically and illustrate the landmarks for a standing male and for a male in a wheel chair.

1.0 INTRODUCTION

Anthropometric landmarks are easily visualized by showing the landmark locations on the body. It is a natural extension to create 3D illustrations of the landmarks by placing them on 3D computer generated bodies. Our goal was to create a 3D anthropometric glossary to allow non-professionals a simple way of introducing anthropometric concepts. In addition the anthropometry standards community can use these 3D illustrations to facilitate communications among their members.

AnthroGloss, our web based visual 3D anthropometric landmark glossary, is freely available at: <http://ovrt.nist.gov/anthroindex.html>. Implemented using VRML (ISO/IEC, 1997), the Virtual Reality Modeling Language, users may easily locate and determine the names of these landmarks. Landmarks are visualized as small spheres located over the body. Users can select the landmark name and the display is adjusted to place the viewer in front of that location. The landmarks also highlight, giving visual feedback. In addition, users can select from among different landmark nomenclatures.

A number of reference planes, such as the Frankfort plane and the coronal, sagittal and transverse planes can be turned on or off. Additional display controls are available via a movable control panel. The initial set of landmark names comes from the CAESAR (Civilian American and European Surface Anthropometry Resource) project (<http://www.hec.afrl.af.mil/cardlab/caesar/>). A second nomenclature from an evolving Society of Automotive Engineers (SAE), Roebuck (Roebuck, 2001) document is also available. Three versions of the system have been implemented, the first is a head only model. Names for the head model are displayed simply by moving the cursor over the spheres, no selection is needed. Arm reach envelopes may also be displayed in these versions.

DISCLAIMER: Mention of trade names does not imply endorsement by NIST.

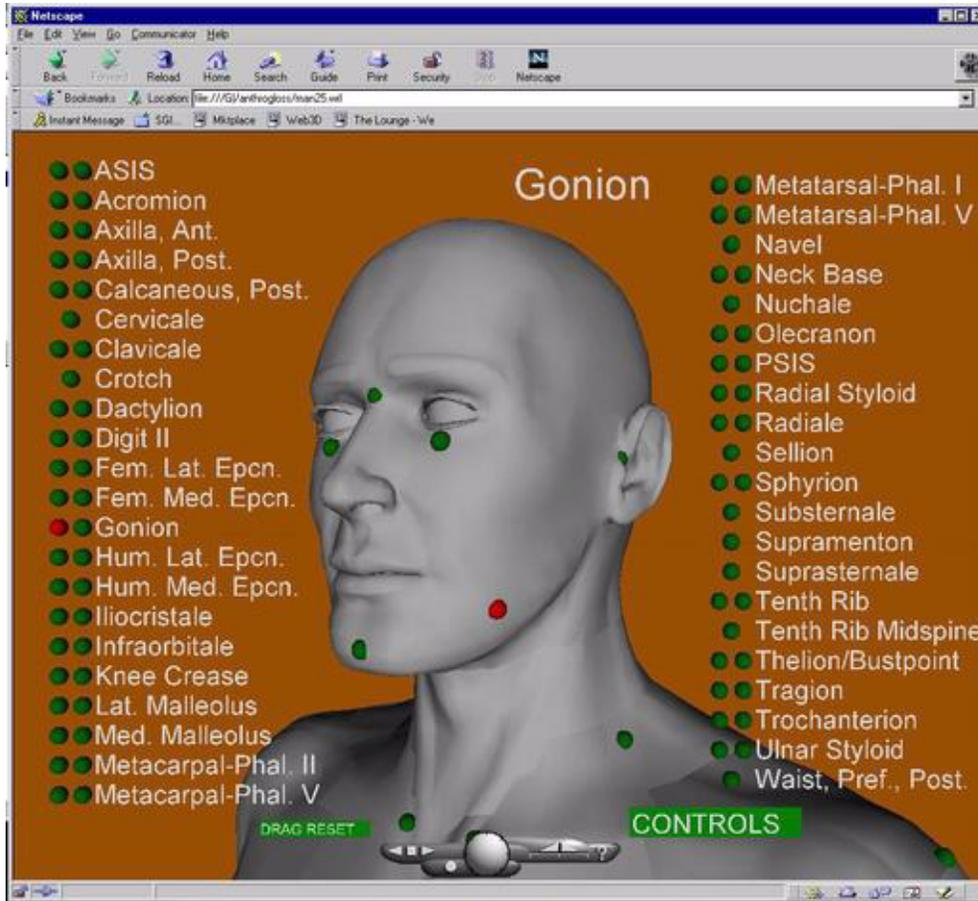


FIGURE 1. AnthroGloss screen with Gonion landmark selected

2.0 MODELING and DEVELOPMENT

There are three versions of the system, one for just the head, a second for a standing man, and the third for a man in a wheel chair. A commercial off-the-shelf human illustration system, Poser (<http://www.curiouslabs.com/products/poser4/index.html>), was used to generate the full body 3D human models and subsequently the landmark markers were placed onto the surface of the body. The first system embodied in the Web site Anthropometric Landmarks of the Head (<http://ovrt.nist.gov/anthroindex.html>) was not created via Poser. Data for the head model was obtained from a head scan provided by the CARD lab (Computerized Anthropometric Research and Design Laboratory) (<http://www.hec.afrl.af.mil/cardlab/caesar/>). The head scan was converted to VRML1 and subsequently to the standard VRML97 format. In addition to the polygon mesh representing the head, we were given a texture image. The texture and range data, which were converted to the polygon mesh by the CARD lab, were captured at the same time, facilitating accurate registration.

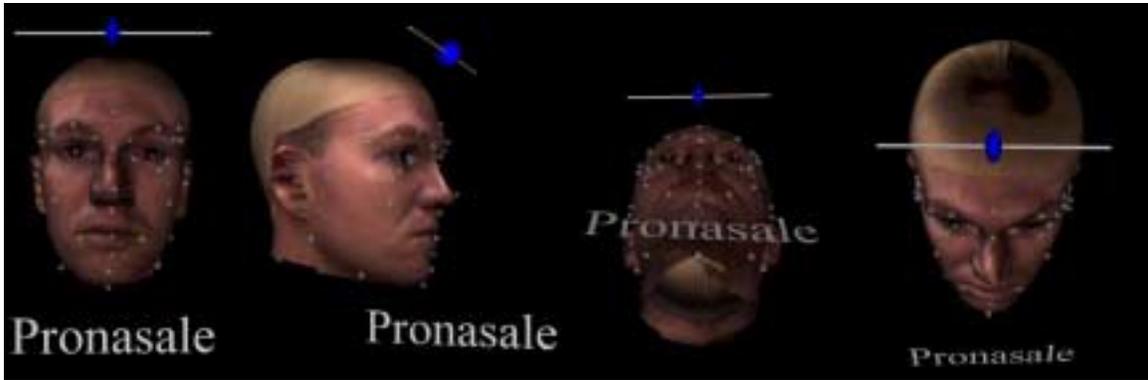


FIGURE 2. Anthropometric Landmarks of the Head from front, right, bottom and top views.

The texture image is a 360 degree scan, which when wrapped around the geometry looks correct. The texture was lined up with the underlying mesh by hand. The slider located above the head allows the user to adjust the transparency of the marker spheres from being invisible to totally opaque.



FIGURE 3. The raw texture data for a 360 degree texture of the head.

The placement of the landmark spheres for all three versions was simply, and laboriously, performed by hand. After placing the spheres into the VRML scene, additional functionality was added to allow the spheres to function as selection and indicator devices. A number of small C programs were created to incrementally add functionality to the evolving system rather than forcing hand editing of the entire VRML world.

3.0 SYSTEM FEATURES

For the full body versions of the system the user is presented with two columns of landmark names. When two spheres are located next to the name, they represent the left and right sides of the body respectively. Users can select

a sphere which causes a change in the viewpoint and the name of the selected landmark to appear in a large size font in the middle of the display.

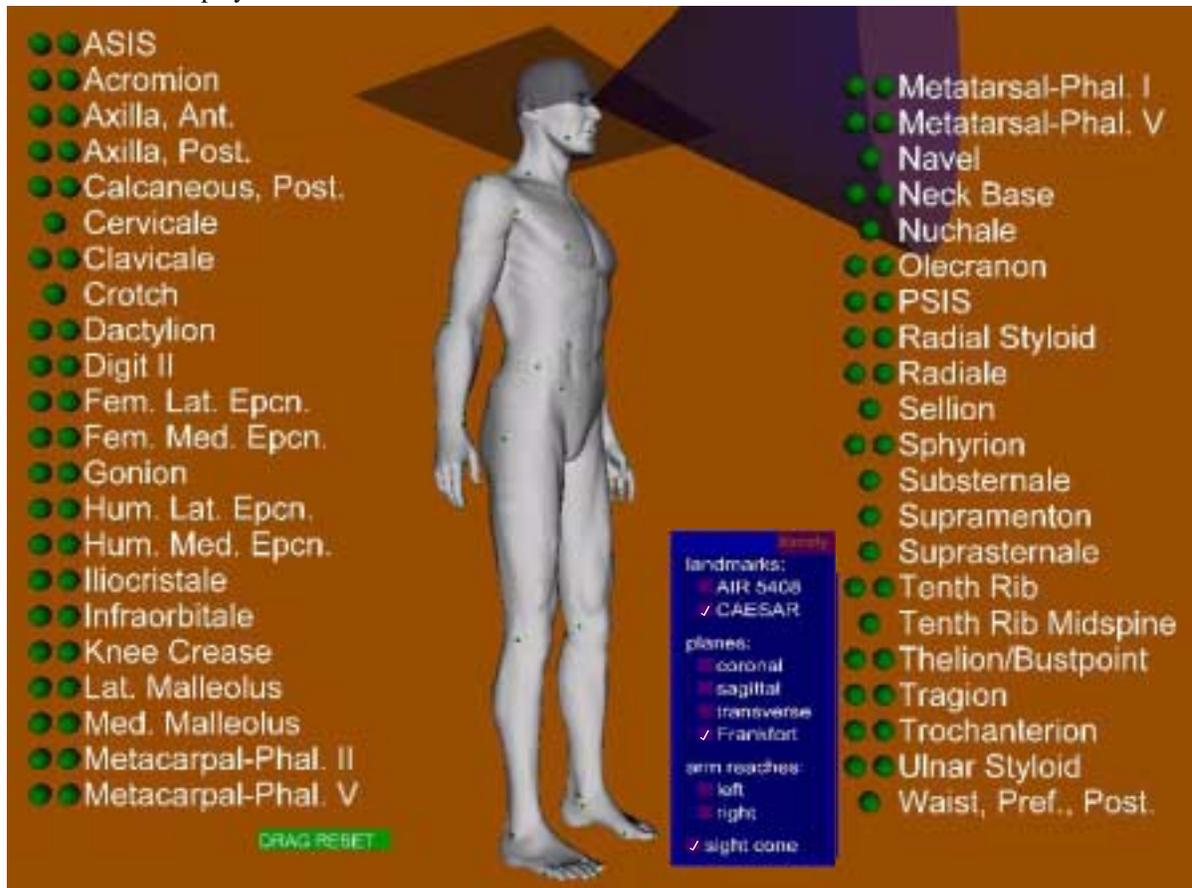


FIGURE 4. AnthroGloss screen layout with Frankfort plane and sight cone indicators turned on.

The list of landmarks can be repositioned by dragging the entire column of names. Reference planes can be toggled on and off via the control panel. The glossary system also allows users to toggle on or off a variety of display indicators. These include the Frankfort plane, a sagittal, coronal and transverse planes. The planes were derived from illustrations in *Anthropometric Methods* (Roebuck, 1993). Arm reach volumes, partial spherical areas, may also be displayed. The areas for the arm reaches for the standing man and wheelchair man were created based on standard illustrations (Dreyfuss, 1993, Woodson et. al. 1992).



FIGURE 5. Three viewpoints corresponding to the selected anthropometric landmark.

A recent addition is the ability to select from among several types of landmark nomenclatures. See the control panel illustrated in Figure 4. Currently the SAE G13 Human Modeling Technology Committee is working on a comprehensive anthropometric landmark dictionary, spearheaded by John Roebuck. Roebuck was kind enough to supply an early version of this dictionary and we have included this version of the SAE AIR 5408 (Roebuck, 2001) names in our latest version of the visual glossary.

4.0 ISSUES, PROBLEMS and FUTURE WORK

Currently there are only three widely used VRML browsers, CosmoPlayer, Contact and Cortona. CosmoPlayer is a dead product and is no longer maintained. Contact and Cortona are both being actively developed and expanded. It is often a challenge to create VRML content that plays satisfactorily in multiple browsers. The visual glossary generally does play back correctly but does on occasion exhibit idiosyncrasies primarily for the landmark feedback. Once the design is solidified we will ensure that the content plays back correctly on the widely used VRML browsers.

In the next version of the system we intend to attach the landmark spheres to the body to enable us to animate the body while keeping the spheres attached. More interestingly we want to change the shape of the body and again keep the landmark spheres attached.

Finally we would like to connect up this visualization work more directly with the AnthroKids database web site (<http://ovrt.nist.gov/projects/anthrokids/>). AnthroKids makes available results of a 1975 and 1977 child anthropometric survey, (Snyder et. al., 1977), the only survey of children ever conducted in the USA. Our goal is to visualize the specific subjects or classes of subjects and display the landmarks over varying body shapes driven by data from traditional surveys or laser scans.

5.0 ACKNOWLEDGEMENTS

Most of the AnthroGloss implementation has been done by Jerry Candela (NIST). The original implementation for the anthropometric head site was created by Greg Seidman currently at Brown University. Thanks to Kathleen Robiette (of CARD Lab) and John Roebuck (of Roebuck Research & Consulting) for providing landmark illustrations and explaining it all.

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